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Pneumovesical ureteric reimplantation in pediatric patients: an intermediate term result

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Abstract

Introduction

Pneumovesical ureteric reimplantation has gained increasing popularity for the treatment of vesicoureteric reflux and vesicoureteric junction obstruction in pediatric patients. In this study we reviewed our experience at an intermediate term basis.

Methods

A retrospective review of all patients with pneumovesical ureteric reimplantation performed in a tertiary referral centre between 2005 and 2015 was carried out. Patients' demographics, operative measures and post-operative outcomes were recorded.

Results

31 patients were identified during the study period. 23 patients had vesicoureteric reflux and 8 patients had vesicoureteric junction obstruction. A total of 42 ureteric reimplantation procedures were carried out. The mean age at operation was 6.1 years old. The mean operative time was 221 minutes. On average the length of hospital stay was 7.4 days. 4 patients required conversion to open approach. 4 patients had low grade residual vesicoureteric reflux after the operation and all of them were treated conservatively. There was no major complication or mortality.

Conclusion

Pneumovesical ureteric reimplantation is safe and effective for pediatric patients. Intermediate term result confirmed its reliability and low recurrence rate. It has good potential to become the preferred approach of choice in the future.

Introduction

Disease process involving the vesicoureteric junction is a common problem in pediatric urology practice. Vesicoureteric reflux (VUR) and vesicoureteric junction obstruction (VUJO) comprise the majority of this condition. Ureteric reimplantation remains the definitive treatment for patients with VUJO. While there are different choices for the management of VUR, ureteric reimplantation serves as the ultimate option for patients who failed medical treatment or endoscopic therapy[1].

Different surgical techniques of ureteric reimplantation have been reported, including both intravesical and extravesical approach[2, 3]. In recent years minimal invasive approach has become an increasingly popular alternative to traditional open ureteric reimplantation. Laparoscopic extravesical ureteric reimplantation was first described by Lakshmanan et al in 2000[4]. Later Yeung et al reported the technique of minimal invasive intravesical cross-trigonal ureteric reimplantation using pneumovesicum with the advantage to avoid intraperitoneal complication[5].

Previously we have reported our early series with the first few cases of laparoscopic pneumovesical ureteric reimplantation in 2008[6]. Here we reviewed the results of our patients at an intermediate term basis after a decade of experience.

Materials and methods

This is a retrospective review of all pediatric patients with pneumovesical ureteric reimplantation performed in our centre between January 2005 and December 2015. Medical and operative records were retrieved for study. Patients' demographics, pre-operative diagnoses, operative measures and post-operative outcomes were extracted from the records.

All patients received either voiding cystourethrogram or MAG-3 scan before the operation to confirm their diagnosis. For VUR patients, operation was offered to those with high grade disease (grade IV to V) or to patients with low grade disease but presented with breakthrough urinary tract infection despite compliant to antibiotics. Patients with residual high grade VUR or recurrent urinary tract infection following previous endoscopic injection therapy were also considered as indication for operation. Similarly, all patients with significant VUJO on MAG-3 scan were offered operation.

The pneumovesical operative technique was similar to previously described[5, 6], which involves bladder insufflation with carbon dioxide to create pneumovesicum. Following bladder anchoring and insertion of three 5mm Step ports, the distal ureter was dissected out same as the open Cohen method. The freed distal ureter was then brought through a submucosal tunnel created over the bladder trigone, and subsequently anchored using monofilament nonabsorbable sutures. The operative technique was similar for both VUR and VUJO patients. Patients were discharged home once they became asymptomatic with

all catheters removed. After the operations, voiding cystourethrogram or MAG-3 scan was performed at 3 months interval to assess any residual or recurrent disease.

Results

A total of 31 patients were identified during the study period. 9 males and 22 females. The mean age at operation was 6.1± 0.6 years old (range 1-17 years). 23 patients had VUR confirmed on voiding cystourethrogram while 8 patients had evidence of significant VUJO on MAG-3 scan. 2 VUR patients were associated with ureteroceles. 11 patients (35%) had bilateral disease and required bilateral reimplantation. Otherwise the laterality of involvement was similar in patients with single sided disease.

A total of 42 ureteric reimplantation procedures were performed. The mean operative time was 221 ± 7 minutes (range 169-318 minutes). 4 patients required conversion to open approach. 3 of them were converted due to significant adhesion and fibrosis following previous endoscopic dextranomer-hyaluronic acid compound injection around the ureteric orifice. Another patient was converted because of persistent air leak and failure to maintain the pneumovesicum. On average the length of hospital stay was 7.4 ± 0.8 days (range 3-22 days). No mortality or major complication was noted. 4 patients had low grade residual VUR after the operation and all of them were treated conservatively. No recurrence of either VUR or VUJO was seen on post-operative imaging studies.

Discussion

The development of pneumovesical ureteric reimplantation has come its long way since the end of last century. The concept of minimally invasive approach for ureteric reimplantation was first attempted by Atala et al in an extravesical approach on a porcine model in 1993[7]. However the experience from past open surgery has warned surgeons against the potential risk to develop voiding dysfunction in patients who underwent extravesical reimplantation. In addition extravesical approach nevertheless carries the risk of damaging intraperitoneal structure during operation. Working in the limited pelvic space in children can also be very difficult even in a laparoscopic environment. The breakthrough did not arrive until Gill et al reported the new technique of laparoscopic cross-trigonal reimplantation in 2001[8]. Yeung et al further modified the operation with the use of carbon dioxide pneumovesicum[5]. It provides a better and clearer intravesical view by avoiding the fluid turbidity. A good working space can also be developed with the use of a reasonable intravesical pressure between 8 to 10 mm Hg. It also made the placement of transurethral suction catheter possible, which is an effective means to remove urine or blood from the bladder during operation.

VUR was still the main indication for ureteric reimplantation[9, 10]. The best treatment approach for VUR is yet a highly debatable topic[11]. Despite the wider application of endoscopic injection therapy, some patients have residual reflux with repeated injections[1]. The low residual or recurrence rate from our data means that pneumovesical approach is a safe alternative. 4 of our VUR procedures were found to have residual disease after operation, all of them being low grade and were managed successfully with conservative

treatment. Interestingly in the 4 patients who required conversion to open approach, 3 of them had previous history of endoscopic injection therapy. We postulated that it was the dextranomer-hyaluronic acid compound injected around the ureteric orifice previously which resulted in severe adhesion and fibrosis, making distal ureter dissection difficult and required a conversion. Pneumovesical reimplantation may therefore be justified as the first line treatment in patients with high grade reflux owing to the increased operative difficulty and risks following previous endoscopic injection treatment.

The use of pneumovesical reimplantation has extended beyond its original application on VUR to include VUJO into the spectrum. There had been recent studies by Bi et al and Liu et al focusing mainly on primary obstructive megaureter[12, 13]. Conclusion from these studies all agreed that the pneumovesical approach is as effective as traditional open reimplantation. Bi et al employed the same cross-trigonal approach as we described and the result has been highly successful with only one residual obstruction out of the 61 procedures performed. Liu et al also reported improvement in over 90% of cases. Data from our series concurred with the above findings with no residual or recurrent obstruction seen in any of the VUJO patients after the operation.

In conclusion, pneumovesical ureteric reimplantation is safe and effective for pediatric patients. It can be applied to patients with VUR and VUJO. Intermediate term result confirmed its reliability and low recurrence rate. It has good potential to become the preferred approach of choice in the future.

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